



**Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore**  
**Choice Based Credit System (CBCS) in Light of NEP-2020**  
**M. Tech (Common for all Engineering branches)**  
**(2021-2023)**

COURSE CODE	CATEGORY	COURSE NAME	TEACHING & EVALUATION SCHEME									
			THEORY			PRACTICAL			L	T	P	CREDITS
			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*					
MTRM301	AECC	Research Methodology in Engineering	60	20	20	0	0	3	1	0	4	

**Legends:** L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit;

\***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

**Course Educational Objectives (CEOs):**

1. The course has been developed with orientation towards research related activities and recognizing the ensuing knowledge as property.
2. To analyze and evaluate research works and to formulate a research problem to pursue research.
3. To develop skills related to professional communication and technical report writing.

**Course Outcomes:**

At the end of the course, students will demonstrate their ability to:

1. Understanding and formulation of research problem.
2. Apply quantitative and qualitative methods used in engineering research.
3. Analyze interpret and evaluate data that relate to engineering problems.
4. Develop skills related to professional communication, technical report writing and publishing papers.
5. Act professionally, autonomously, ethically and in teams to produce a professional product.

**Syllabus**

**Unit-I**

**Introduction to Research Methodology:** - An overview of Research process, Types of research; Approaches to research, Importance of criticism in Literature review, identifying research gaps; Formulation of research problem; Research design,

**Data:** Primary and secondary data-sources, advantages/disadvantages; Sampling and primary data collection, sampling size, random and structured sampling

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#### Unit-II

**Measurement and Scaling Techniques:** - Types of scales, Criteria for good measurement, Attitude measurement - Likert's scale, Semantic differential scale, Thurstone-equal appearing interval scale.

**Statistical Tools for Data Analysis:** - Measure of central tendency, Measures of dispersion, Correlation and Regression, Formulation of hypothesis, Type I & Type II error, Parametric test, non-parametric test.

#### Unit-III

**Research Methods I** - Use of computer software in research and understanding the limitations. Multi-attribute decision making methods, Data envelopment analysis, Grey relational analysis etc., Multidisciplinary research problems, Synthesis of disciplinary research findings; Reliability and sensitivity analysis.

#### Unit-IV

**Research Methods II** - Modeling and simulation of engineering problem; Mathematical modeling-formulation, calibration, validation, application; measurement design – validity, reliability, scaling and sources of error. Mathematical programming methods, Numerical analysis, Optimization techniques, Design of laboratory experiments and field tests.

#### Unit-V

**Academic Writing Skills and Presentation** - Layout of a Research paper, research report, Thesis structure, Impact factor of Journals, Ethical issues related to publishing, Plagiarism and Self-Plagiarism. Reference Management Software like Mendeley, Software for paper formatting like LaTeX/MS Office, Software for detection of Plagiarism. Guidelines on how to write research papers. Content of Poster presentation, Power point presentation, Oral presentation

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**Text Books -**

1. C.R. Kothari, 2012. Research Methodology Methods and Techniques, 3/e, Vishwa Prakashan,
2. Montgomery, Douglas C., 2007. Design and Analysis of Experiments (Wiley India).
3. Chawla, D. and Sodhi, N., 2011. Research methodology: Concepts and cases. Vikas Publishing House.

**Reference:**

1. Donald H.McBurney, "Research Methods", 5th Edition, Thomson Learning, ISBN: 81-315-0047.
2. Donald R. Cooper, Pamela S. Schindler, "Business Research Methods", 8/e, Tata McGraw-Hill Co. Ltd.,
3. Timothy J. Ross, "Fuzzy Logic with Engg Applications", , Wiley Publications, 2nd Ed[d]
4. Thiel D.V. "Research Methods for Engineering", Published by Cambridge University Press, UK
5. P.J. van Laarhoven & E.H. Aarts, "Simulated Annealing: Theory and Applications" (Mathematics and Its Applications).

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MTCE 2201	DCC	System Analysis and Urban Transportation	60	20	20	30	20	2	1	2	4

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**Course Educational Objectives (CEOs):**

1. Justify the need for urban transportation system planning
2. Plan the process of trip generation and distribution
3. Understand the four steps of urban transportation demand forecasting
4. Communicate transportation planning ideas effectively

**Course Outcomes (COs):**

1. To understand principles and techniques of traffic forecasting.
2. To understand concept and purpose of trip generation.
3. To analyze different distribution models and assignment of model.
4. Understand economic analysis in urban transportation.

**Syllabus**

**UNIT I**

**09 Hrs.**

Probability; statistics for traffic engineering design; Random variable and statistical measures; Basic concept of probability, probability laws, Binomial, Poisson, normal and exponential distributions

Sampling theory and regression analysis; General consideration of the accuracy; Cost and time requirements of data collection; Sampling theory and principles for determining sample size and accuracy relationship; Principles of the population mean and standard deviation; Regression analysis examples

**UNIT II**

**08 Hrs.**

**Traffic forecasting:** Principles and techniques; Demand, price and capacity relationships; Price elasticity; Forecasting for long term demand, variables; Determination of the design hourly volume; Planning methods of transport system planning, stages of planning; Transportation study area, and collection of travel data; External cordon and screen-line; Survey, zoning types of surveys

**UNIT III**

**08 Hrs.**

**Trip Generation Models:** Introduction and definition; Factors governing trip generation; Multiple linear regression analysis; Aggregated and disaggregated analysis; Category analysis.

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**UNIT IV**

**08 Hrs.**

**Distribution Models:** Methods of trip distribution; growth factor models, gravity model, tanner model, intervening opportunity model, competing opportunity model

**Assignment models:** General principle; Assignment techniques, all or nothing assignment, multiple route assignment, capacity restraint assignment; Diversion curves.

**UNIT V**

**08 Hrs.**

**Economic analysis:** Need, costs and benefits, time horizon in economic assignment; Basic principles; Methods of economic evaluation; Traffic and the environment; Effects of traffic on the environment

**Text Books:**

1. Kadiyali L.R., Traffic Engineering and Transport Planning, Khanna Publication
2. Martine Wool and Brain V. Martin, Traffic System Analysis, McGraw Hill Text

**Reference Books:**

1. Hutchinson B.G., Principles of UTS Planning, Mc Graw-Hill Publish.
2. Saxena, Traffic Planning and Design, CBS Publishers & Distributors.

**List of Practical's**

1. Study area delineation & travel survey design
2. Home interview survey and data analysis
3. Calibration of trip generation models
4. Calibration of singly / doubly constrained gravity models
5. Calibration of utility-based mode choice models
6. Trip assignment by AoN / CR Method / Multipath/ Equilibrium methods.

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MTCE 2202	DCC	Transportation Planning	60	20	20	30	20	2	1	2	4

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**Course Educational Objectives (CEOs):**

1. Basic understanding of what transportation planning is, its theoretical backgrounds and applications
2. Ability to understand the important concepts about public transport system

**Course Outcomes (COs):**

1. To introduce the issues of transportation planning and transportation policy
2. To introduce travel survey method for understanding travel behaviour
3. To introduce the key concepts of the urban transportation planning system
4. To introduce the fundamental concepts of public transport system such as system, technology, and quality of service

**Syllabus:**

**UNIT I**

**07 Hrs.**

**Transportation in Society:** Role of transportation (Land, air, water) in civilization, economic, social, political; Environmental roles of transportation today in India

**UNIT II**

**08 Hrs.**

**Fields of Transportation Engineering:** Different fields involved system planning; Scientific approach to model development; Science and professional judgment in organizations

**Component of Transportation System:** Transport technology, transportation systems, transportation network and their analysis; Vehicle and containers

**UNIT III**

**09 Hrs.**

**Vehicle Motion:** Equations of motion, resistances, path characteristics, prediction of vehicle performance; Generalized vehicle performance relationships; Work, energy, and fuel consumption

**Continuous Flow System:** General characteristics, belt conveyors, pipelines, capsule pipe lines, concepts of flow and design

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**Terminals:** Functions, analysis, process flow charts, terminal processing time, waiting times, capacity and level of service concepts; Simulation probability; Density functions; Queuing theory, passenger and freight terminals, air, bus, railroad

#### UNIT IV

09 Hrs.

**Transport Costs, Demand and Supply:** Concepts, types, future costs and present value; treatment of inflation; cost estimating methods; choice of technology and cost output relationships; demand function, demand models, urban travel forecasting model, demand for freight transportation; Projection techniques; Theory of transport supply, supply characteristics of transport facilities, pricing, supply characteristics, O carriers, supply relationships for an urban transit time.

**Transportation Network Flows:** Merging of demand and supply relationships; Economic market equilibrium and extension to include level of service, network equilibrium traffic assignment.

#### UNIT V

08 Hrs.

**Environment impacts:** Noise impact; air pollution; evaluation procedures; situation in India.

**Decision making:** Characteristics of transportation problems, problem solving process; Multiple objective evaluation and selection methods, selection procedures; Economic evaluation methods; Long range transportation planning; Types of planning process; Data base, alternatives and their generation; Operation plans, system operation and management; Network relationships, TSM; Management scheme for reducing congestion in CED and on streets; Reducing travel peaks, traffic Engg. Measures; Road Traffic models for CBD, corridor operation planning, maintenance; integrated operation planning and design of a system, Implementation; Urban transportation legislation, legal powers, financing.

#### Text Books:

1. Edward K. Morlok, Introduction to Transportation Engineering and Planning, Mc Graw Hill Book Co.
2. John W. Dickey, Metropolitan, Transportation Planning, Mc Graw Hill Co.
3. Kadiyali L.R., Traffic Engineering and Transportation Planning, Khanna Publication, Delhi.

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**References Books:**

1. Wohl, Martin and Brien Martin, Traffic System Analysis for Engineers and Planners, Mc Graw Hill Book Co.
2. Hutkinson, Bruce D., Principles of Urban Transport System Planning, Mc Graw Hill.

**List of Practical's**

Formulation and evaluation of the following transportation projects-

1. Rotary Design
2. Traffic signal Design
3. Multi-level / Surface level Parking Design
4. Public transport route evaluation
5. Transport Planning for a small area

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MTCE 2203	DCC	Design and Construction of Rigid Pavement	60	20	20	0	0	2	1	0	3

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**Course Educational Objectives (CEOs):**

1. To study the behavior of pavements under various loads
2. To design the flexible and rigid pavements using different Empirical, semi-empirical and theoretical approaches
3. To understand the concept of Pavement Management System, pavement failures and its evaluation

**Course Outcomes (COs):**

Upon completion of this course, the students should be able to:

1. Know the stresses, strains and deflections in rigid and flexible pavements; traffic loading; and material characterization.
2. Design methodologies for both rigid and flexible pavements
3. Understand the structural and functions failure and the evaluation of pavements

**Syllabus:**

**UNIT I**

**07 Hrs.**

**Theories of Design of Rigid Pavements:** Westergaard's analysis; Picket's Solution, Westergaard's formula for loads on applied area; Finite difference method, linear elastic layer method, finite element method; Deflection in rigid pavements

**Design of Concrete Pavements:** ESWL for rigid pavements; Load stresses and temperature stresses; Effect of repetition of loads, Concepts of stress ratio, IRC design methods as per revised code; PCA chart method; Reinforcement design in CC pavement; Design of airfield pavements

**UNIT II**

**08 Hrs.**

**Pavement Joints:** Need of joints, Different types of joints, Contraction and warping joints; Design of dowel bars and tie bars; Filling and sealing materials of joints

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**UNIT III**

**08 Hrs.**

**Continuously Reinforced Concrete Pavements:** Width and thickness of slab; Reinforcing steel design construction criteria, factors affecting; Crack width and spacing of CRC pavements; Design of CRC pavement for highway and airfield.

**UNIT IV**

**09 Hrs.**

**(A) Design of Prestressed Concrete Pavements:** Stresses in pavements; Thickness design and prestressing techniques, precast prestress CC pavement slab, advantages and constructions

**(B) Evaluation and Strengthening:** Performance evaluation, safety, serviceability and durability concepts; Design of rigid overlays on rigid pavements and flexible pavement, FRC overlays; Construction and maintenance.

**UNIT V**

**08 Hrs.**

**Construction of Rigid Pavements:** Formwork, mixing, spreading, compaction and finishing, slip form pavers, Quality Pavement concrete (QPC).

**Text Book:**

1. H.M.S.O. Concrete Road, Design and Construction.
2. Yodar E.J., Principle of Pavement Design, Wiley India Pvt Ltd; Second edition

**References Books:**

1. IRC-18-1981, Standards, Specifications and Code of Practice for Construction of Concrete Roads.
2. IRC-58-1988, Guidelines for the design of Rigid Pavements for Highways.
3. IRC SP-49-1988, Guidelines for the use of Dry Lean Concrete as Subbase for Rigid Pavements.
4. IRC-15, Standard Specification and Code of Practice for Construction of Concrete Roads.
5. IRC-44-1976, Tentative Guidelines for CC Mix Design for Pavements.
6. IRC-SP-46, 1977, SFRC for Pavement.
7. Sharma S.K., Principle Practice & Design in Highway Engineering.

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MTCE 2204	DCC	Analysis and Planning of Mass Transportation System	60	20	20	0	0	2	0	0	2	

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**Course Objectives:**

Student will be able to understand planning in urban transport, economic evaluation, network planning and development of mass transportation.

**Course Outcomes:**

1. To understand different aspects in planning of urban transport
2. To analyze the key factors in economic evaluation of transportation system.
3. To design bus route network planning system.
4. To understand the development of mass transportation.

**Syllabus:**

**UNIT I**

**05 Hrs.**

**Urban Transportation Planning:** Terms, problems, issue process; Inventories, goals and plans; Measures to meet problems; UTP models; Generation, distribution, modal split; Route Assignment; Urban vs. rural development.

**UNIT II**

**06 Hrs.**

**Data Collection and UTP:** Reasons, sampling, kinds, methods of collection; Processing, population and land use, forecasting; Surveys – HIS, RIS, VKTS, PKTS; Network inventory, O-D; Application of IT.

**Economic Evaluation Transportation Proposal Methods:** IRR, NPV, B/C, ROR, Comparison of methods; Relation between flow, speed and travel cost.

**UNIT III**

**06 Hrs.**

**Mass Transportation Demand Estimation:** Choice of public mass transport, Factors related to mass transport and commuter behaviour; Regression models; Diversion curves, Multinomial log it model; Basic approaches for modal split; TEM and TIM

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**UNIT IV**

**06 Hrs.**

**(A)Bus Route Network Planning:** Different system of bus network generation; Activity intensity System; Demand direction.

**(B)Bus Scheduling and Terminal Design:** Marginal ridership concepts; Data required; Allocation on each route, fixing of bus fare; Terminal facilities required; Site exploration; space requirement; Pattern bus depot

**UNIT V**

**06 Hrs.**

**Taxonomy of Transportation system and Development of Mass Transportation:** Complete transportation package for urban area network, vehicle terminal, control system; Efficiency of modes; BRTS; Justification and economic evaluation demand; Scheduling, number of buses, planning of bus stops, spacing, ETB, Chartered buses, Dial-o-Bus, RRT, LRT, Para transit; Automated Highway; Monorail, Mini rail.

**Text Books:**

1. Verma and T.V. Ramanayya, Public Transport Planning and Management in Developing Countries, CRC Press,2014
2. Vuchic Vukan R., Urban Transit: Operations ,Planning and Economics, Prentice Hall,2005

**Reference Books:**

1. Grey G.E., and Hoel L.A., Public Transportation, Prentice Hall,1992

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